ORGANIC SOLVENT NANOFILTRATION WITH NOVEL PERFLUOROPOLYMER AND OTHER POLYMERIC MEMBRANES

Kamalesh K. Sirkar, Otto York Department of Chemical, Biological and Pharmaceutical Engineering, New Jersey Institute of Technology, USA
sirkar@njit.edu
John Chau, Otto York Department of Chemical, Biological and Pharmaceutical Engineering, New Jersey Institute of Technology, USA
Prithis Basak, Otto York Department of Chemical, Biological and Pharmaceutical Engineering, New Jersey Institute of Technology, USA

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A very large variety of membranes polymeric or otherwise have been investigated over the last two decades for organic solvent nanofiltration (OSN). The materials and structures used to make OSN membranes include among others the following: poly (dimethylsiloxane) (PDMS); mixed matrix membranes (MMMs) of PDMS with zeolites and other fillers; asymmetric integrally skinned polyimide (PI) membrane crosslinked with aromatic or aliphatic diamines; polyaniline; polypyrrole; interfacially polymerized polyamide with or without functionalized carbon nanotubes; carbon-based membranes including graphene. Most of the studies involved polymeric membranes. One of the weaknesses of most polymeric membranes is their varying tendencies for swelling with demanding organic solvents aprotic or otherwise; this gets reflected in the solute rejection behaviors of such polymers. Diamine-crosslinked PI membranes show excellent resistance to organic solvents but may have some swelling in the presence of water. To this end we have started studying membranes from particular classes of fluoropolymers which are extremely inert to solvents commonly used including aprotic ones. Initially these membranes were studied for pervaporation-based selective removal from organic-organic mixtures and aqueous-organic mixtures. Next they were studied with a variety of solvents for OSN over a considerable pressure range. We first report results of solvent flux and dye solute rejection for such membranes in composite form. These studies were made with dense flat membranes of two different thicknesses supported on appropriate porous supports. Studies were made with solvent mixtures as well, e.g. n-heptane-toluene to investigate the application of solvent exchange. Solvent sorption studies have been conducted as well with these polymers to develop a better understanding of separation and transport through such polymeric membranes. Other PI-based membranes were also studied for particular cases.